

The width of frons as a variable feature in the Calliphorinae (Diptera), with descriptions of two new species.

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In one of his contributions to the Muscidae collected by the British Ruwenzori Expedition 1934/35, Dr. F. van Emden (1951) mentioned the unusual occurrence of dichoptic males:

"A remarkable, though of course not large, proportion of the new species from higher elevations (e.g.) *Spilogona dichoptica*, *Helina rotundiceps*, some species of *Xenomyia*, etc. are conspicuous by their dichoptic males, and this condition is especially interesting, where it occurs in a geographical race of a species which is otherwise holoptic in the male, as in the case in *Limnophora aculeipes eurymetopa* Emd. The holoptic type form of this species occurs in Abyssinia, a holoptic sub-species is found on various high mountains in Kenya and on Mt. Kilimandjaro, and the dichoptic subspecies *eurymetopa* on the Nyeri Track of the Aberdares. Dichoptic males may occur sporadically in normally holoptic species and are considered to be intersexes. In *L.eurymetopa*, however, all the four males at hand and at the same time all the males belonging to the species *aculeipes* and found on the Nyeri Track, are dichoptic, so that the dichoptic head of the males is likely to be the character of a geographical form and not of intersexes in this case. It is well known that there is a tendency in insects of high altitudes to abandon flight, and similarly, a reduction of the eye-size is frequently linked with more stationary habits. It is thus not impossible — though far from proved — that the relatively large proportion of dichoptic species on the higher mountains visited by the Expedition is a consequence of more stationary habits of these flies."

Dichoptic males in groups which normally contain holoptic ones or at least males with a relatively narrow frons, are therefore explained by van Emden in two different ways. Firstly as intersexes, secondly by the hypothesis that the ecological conditions of higher altitudes cause the flies to adopt a more stationary mode of life and as a consequence, the eye size is reduced and the flight abandoned.

Intersexes are very rare in nature and, furthermore with very few exceptions asymmetrically built. Those dichoptic males, however, which occasionally

occur in the same population together with normal holoptic ones, are, as a rule, of an equal bilateral structure, with a hypopygium which is in no respect different from that of the normal males. The only difference is, that they have a broad frons which makes them more or less similar to the female. I believe that this fact has induced Dr. van Emden to take these broad-fronted males for intersexes. But it may be pointed out that there are many other groups of higher diptera in which both sexes are dichoptic and in which the males externally strongly resemble the females, indicating that a broad male frons is by no means an outstanding feature in the *Calyptrata* requiring such an unusual and unnatural explanation.

The second hypothesis is not new and is usually held by authors who incline to a neo-lamarckistic opinion of evolution. The geneticists, however, have shown us that evolution most probably took just the opposite direction. The specimens comprising a population do not show equal gene complements but, on the contrary, the genes are represented by a great number of alleles providing the species with the potentiality of producing specimens with various physiological reactions and morphological appearances. The population, therefore, consists of a greater or lesser number of biotypes which are favoured by the environmental factors, or destroyed or suppressed if they are unsuitable. But not all physiological and especially purely morphological, features will place their bearer at pronounced advantage or disadvantage, but they may be almost neutral and the allele concerned may spread by mere chance through a population.

Returning to the feature of the broad frons, its predominant occurrence at high altitudes may be due to an advantageous physiological character genetically linked with it, or it may depend on a more or less neutral allele which has spread through the population on account of the latter's isolation and small size (cf. Wright in Huxley, 1949.)

The occasional occurrence of broad-fronted males in a population with normally holoptic ones may result from an accidental gene-combination, only proving that those combinations are possible within the population. At higher altitudes, in small populations, such a gene-combination may have become dominant. Regarded from this point of view, the phenomenon of the broad frons is the same in both cases, and there should also be examples where this feature has swept through a population which is not restricted to a locality of high altitude.

In the subfamily of *Calliphorinae* there are several examples of the occurrence of broad-fronted males in groups which are normally holoptic in this sex. In the following sections, I am going to discuss a few of these facts as far as they concern the Ethiopian and Palaearctic regions.

Phumosia patersoni, a new broad-fronted species from the Cape Coast.

Mr. H. E. Paterson of this Institute caught on the 19th February, 1954, in the temperate rain-forest of Port St. Johns, Cape Province, a male of a

remarkable new *Phumosia* species. In general appearance, it is fairly similar to *P. imitans* Vill. (= *caerulea* Vill., = *coeruliventris* Mall.), a species widely distributed in the Central and West African rain-forests, and it is also with certainty closely related to it. It has, however, a very broad frons with external vertical and frontal bristles. The hypopygium is distinct from that of *imitans*, and we are dealing with a good species characterized by the following features:

Male — Eyes bare, with small facets only, frons at the narrowest point near the tip of the ocellar triangle $\frac{1}{3}$ rd as wide as the eye is long, very slightly widened to the vertex, strongly widened to the antennal groove; frontal stripe reddish brown, almost parallel, ocellar triangle and hind part of parafrontalia blackish, lower part of them and parafacialia yellow-brown like the remaining face including antennae and palpi. Third antennal segment $2\frac{1}{2}$ times as long as the second, arista with long hairs on both sides up to the tip; antennal groove without carina. Bucca yellow-brown too, its height about $\frac{1}{4}$ th of the eye-length. Inner and outer vertical bristles strongly developed, furthermore one strong and one weak pair of diverging ocellars, one pair of reclinate frontals and 6 pairs of parafrontal bristles present. Parafrontalia moreover beset with several black setae, parafacialia bare, only whitish dusted like other parts of the head. Vibrissae long and thick, facial ridge on the lower third beset with short black bristles, peristomal bristles black and strong, buccal hairs black, towards and on the occiput yellowish hairs predominate

Thorax dorsally predominantly metallic blue, on the pleurae yellow-brown, relatively densely whitish dusted. Chaetotaxy: ac = 2+2, dc = 2+4, ia = 1+3, ph = 2 (outer present), h = 3, prs = 1, n = 2, sa = 3, pa = 2, sc = 5+1, one weak and one strong pp and pst, st = 2:1. Prosternum, propleuron and alar declivity haired. Pro- and post-stigma yellow-brown. Wings with a slight blackish tinge, veins black-brown, costal spine present, but short and indistinct, r_5 dorsally with setae which almost reach r—m, m with a rounded bend of 90° , R_5 widely open, thoracic squama relatively broadly lobate, but distinctly longer than broad, with a black-brown tinge, halter yellow. Legs totally yellow-brown, hairs and bristles black, fore-tibia with 2—4 ad and one long submedian pv; mid-tibia with a long median ad, a short pd and 2 longer pv; hind-tibia with 3 ad, 2 pd and 2 weak av; claws and pulvilli of normal size.

Abdomen as long as broad, yellow-brown and dorsally with a metallic-blue lustre. Hind margin of 5th tergite with a complete row of bristles, 4th and 3rd tergites with similar rows of marginal bristles, which are more or less interrupted in the middle. Hypopygium (fig. 1) with relatively slender cerci and hook-shaped paralobi.

Length: 9 mm.

Distribution: Temperate rain forest at Port St. Johns, Cape Province. Holotype in the collection of the South African Institute of Medical Research, Johannesburg.

Notes: This species is clearly distinguished from all other *Phumosia* species, and there is no doubt that the male before me represents a good species in spite of only a single specimen being known. The nearest related species is, as has already been pointed out, *Phumosia imitans* Vill., which is fully holoptic and quite a common fly in the Central African mountains. There are no dichoptic male specimens known to occur within this species. The broadest width of frons we meet with in other species of Ethiopian *Phumosia* measures 1/6th of eye-length which is still too narrow to allow the external vertical and the frontal bristles to become apparent. It is interesting to note that two species with such a relatively broad frons, namely *P.nudiuscula* Bigot (width 1/6—1/7) and *P.stabulans* Bezzi (width 1/6—1/8) are *Phumosia* species which have extended their areas of distribution to the southern coast of Africa, but they live there not only in the mountains but also near the beach at almost sea level. *P.patersoni* with the broadest frons has now been found at a very low altitude too, and it has probably a very isolated area of distribution and comes from a small population.

The Genera *Tricyclea* Wulp and *Keniella* Malloch.

Malloch (1929) separated his genus *Keniella* from *Tricyclea* by a broad frons which is provided with a distinct pair of external vertical, reclinate frontal and proclinate fronto-orbital bristles, whereas in *Tricyclea*, at most a pair of external vertical bristles is weakly developed as in *T.latifrons* Curran (cf. Zumpt, 1953a).

Up to now, there was only one species of *Tricyclea* known in which holoptic and dichoptic males occur, namely *T.fasciata* (Mcq.) The holoptic form, *T.fasciata fasciata*, is recorded from the following areas in West and Central Africa: Sierra Leone, Liberia, Togo, Gold Coast, Nigeria, Cameroons, Kenya, Uganda and Tanganyika, whereas the dichoptic form, regarded as a subspecies, *ferruginea* Wulp, was received from S. Rhodesia, Bechuanaland and S.W. Africa. Although at the time of terminating my paper on the genera *Hemigymnochaeta* and *Tricyclea* (Zumpt 1953a), no records of this species were available from the Union, I expected specimens would eventually be collected. I have now received a series of 3 ♂♂ and 2 ♀♀ from Illovo Beach in Natal (leg. Paterson, 27.II.1954); however, they do not belong to the ssp. *ferruginea* but to the nominate form.

According to the present records of this species the holoptic and the dichoptic feature in the male sex seems to be geographically separated and we can use it, as van Emden has done in the case of the muscid *Limnophora aculeipes* Stein, to characterize subspecific units. The broad-fronted subspecies of *T.fasciata*, however, is not a mountain form, but occurs in an area with subtropical evergreen and deciduous bush vegetation. We shall see below that this area is characterized by the presence of other broad-fronted *Tricyclea* species.

Dr. P. Basilewsky, Tervuren, was kind enough to entrust to me the *Calliphorinae* of the Congo Museum. Among this rich material, I found a

number of male specimens of *Tricyclea analis* Malloch with a broad frons mixed with normal holoptic males from the same localities (Rutshuru and Vieux-Kilo).

T. analis has been put by me (1953a) with a question mark into the synonymy of *T. semicinerea* Bezzi. In the meantime, by the kindness of Dr. R. Kellogg, U.S. National Museum, Washington, I have received a paratype male of *T. analis* and have to state that it is identical with *T. currani* (**syn. nov.**) described by me as new in the abovementioned paper. It was based on a single male which is, as I now know, quite aberrant in respect to the thoracic pattern. I have received several more series of this species from various localities, which show an enormous variability regarding the pattern of thorax, abdomen and wing. The black disc on the mesonotum is of varying size and shape, the hind segments of the abdomen may be totally darkened or they are banded, the wings may be wholly hyaline, or they have one or two dark, subcostal spots. The only reliable feature is represented by the hypopygium, but even this shows a slight variability in the shape of the cerci, paralobi and even the phallosome (cf. figs. 2 and 3 with fig. 18 in Zumpt, 1953a.)

This individual variability is now further increased by the finding of broad-fronted males in the same population. There are 3 specimens from Vieux-Kilo before me, the frons of which measures at the narrowest point about 3/10 of eye-length, whereas in a fourth male with the same locality and date, the eyes are touching as in the type specimens. The other broad-fronted male from the Rutshuru is a little deformed but otherwise shows no differences from the males from Vieux-Kilo. The "female character" of these males is still more pronounced than in *Phumosa patersoni*. There are not only external vertical and frontal bristles developed, but also a pair of fronto-orbitals.

These broad-fronted "individual variants" should not be designated with a scientific name. They may be classified as *f. latifrons*, wherever they occur in the genus, without an author's name and not be subject to the rules of nomenclature (cf. Mayr-Linsley-Usinger, 1953; and Zumpt, 1953a).

These formae *latifrons* of *T. analis*, the specificity having been proved in each case by dissecting the terminalia, show the same combination of characters as given as generic features of the genus *Keniella* Malloch (cf. Zumpt, 1953b). The conclusion to be drawn is, I believe, that *Keniella* is congeneric with *Tricyclea* (**syn. nov.**) and that the former only includes species in which the gene of broad frons has become dominant.

Fig. 1. *Phumosa patersoni* n.sp.

Cerci and paralobi in dorsal view, phallosome in lateral view.

Fig. 2. *Tricyclea analis* Malloch.

Paratypical specimen from Benguella, Angola, Cerci and paralobi, 5th sternite in dorsal view, phallosome in lateral view.

Fig. 3. *Tricyclea analis* Malloch.

Male terminalia of a specimen from Kishale, Belgian Congo.

Fig. 4. *Tricyclea par* n.sp.

Cerci and paralobi in dorsal view, phallosome in lateral view.

It is interesting to note that 3 species of this "*Keniella* group", namely *martini* Zpt., *claripennis* Séguy and *par* n. sp. (described below) have all been collected in the former mentioned area in which also *T.fasciata ferruginea* Wulf occurs. The fourth species, *K.somereni* Malloch, has remained unknown to me. It was described from Rabai, Kenya, and seems to be similar to *T.diffusa* Malloch.

The outer features of *T.claripennis* Séguy are quite characteristic. In the shape of the hypopygium, however there is a striking resemblance to *T.analis*, so that at first I believed I would have to unite it with this species. Yet the paralobi seem to be constantly more slender, and also, there are differences in the shape of the phallosome which may prove the specificity of *T.claripennis*. *T.martini* Zpt. is a good species and cannot be taken as the broad-fronted subspecies of any other *Tricylea*. The same is true for *T.par* which is characterized as follows:

***Tricylea par* nov. spec.**

It is readily separable from the other species of the "*Keniella* group" by the hyaline wings in combination with an unicoloured yellow-brown body.

Male — Frons at the vertex measures a little less than half of the eye-length; frontal stripe dark yellow, parallel, parafrontalia and facialia silvery dusted,

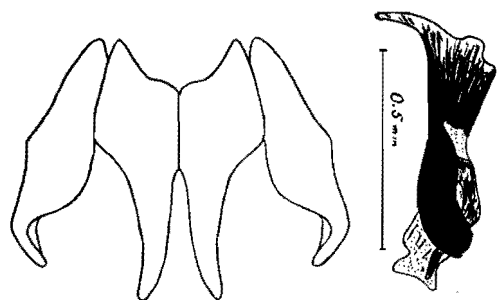


Fig. 1

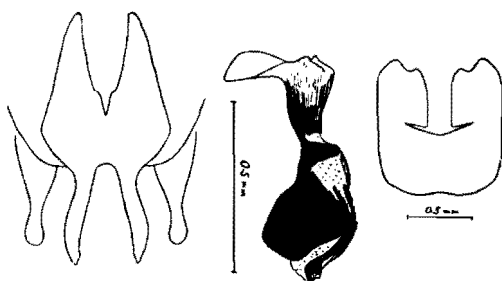


Fig. 2

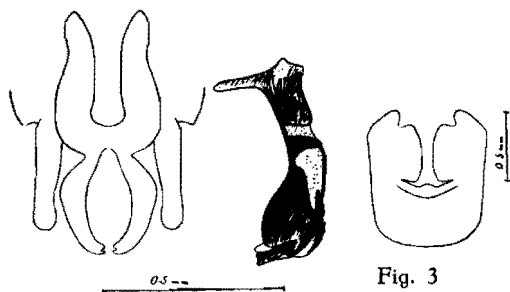


Fig. 3

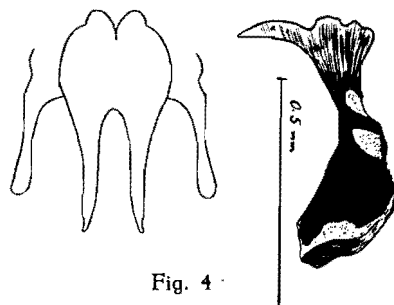


Fig. 4

the former, at the tip of the ocellar-triangle, one third to half as wide as the frontal stripe. Eyes oval, the inner facets very slightly enlarged. Face and buccae whitish yellow, antennae dark yellow, third segment about three times as long as the second, arista with long hairs on both sides, but the last fourth to third bare. Buccae $2/5$ as high as the eye. The chaetotaxy consists of long inner and outer vertical bristles, a pair of reclinate frontal and one pair of proclinate fronto-orbital bristles, ocellars present, 6—7 parafrontals each reach the second antennal segment; besides them, the parafrontalia are provided with black setae which are continued beyond the parafrontals by light coloured setae and almost cover the whole parafacialia. Facial ridge on the lower half with a row of black bristles which is continued by the long peristomal bristles, buccae densely beset with yellowish hairs. Proboscis yellow, palpi slightly enlarged terminally, yellow with black bristles.

Thorax yellow brown, whitish dusted, without a dark pattern except the blackish postnotum. Chaetotaxy exactly as in *martini*: ac = 3+3, dc = 3+4 (1st presutural ac and dc weak), ia = 1+3, ph = 2 (outer wanting), h = 3, prs = 1, n = 2, sa = 3, pa = 3, scutellum with 3 long and 3 short marginals, furthermore one pair of short discals, one long pp and pst, st = 1:1, propleura and prosternum haired, also alar-declivity with a few setae. Pro- and poststigma light yellow. Wings wholly hyaline, veins yellow, costal spine present, but short and indistinct, r_5 dorsally with a row on setae which slightly surpasses r—m, R_5 open, m terminally scalloped; thoracic squama broad, halter yellow. Legs yellow, front-tibia with 3 ad and one submedian pv, mid-tibia with 2 pv, hind tibia with 2 pd, 1 ad and 1 av, claws and pulvilli short.

Abdomen unicoloured yellow-brown like the thorax. Hypopygium (fig. 4) with slender paralobi and pointed, relatively widely separated cerci.

Female — In every respect like the male and only separable by the external genital organs.

Length: 4.5—5 mm.

Distribution: 2♂♂ and 1♀ from Martin's drift, Bechuanaland, leg. H. E. Paterson, February, 1953. All types in the collection of the South African Institute for Medical Research, Johannesburg.

Variability of frons in the Palaearctic species of *Pollenia* R-D.

The genus *Pollenia* contains several species which are characterized by a great variability of the width of frons, all forms of which may occur in the same population, or a narrow (forma *angustifrons*) and a broad (forma *latifrons*) form may more or less exclude each other.

One of the most common *Pollenia* species is *P. rudis* (Fabr.) Its width of frons at the narrowest point ranges from $1/28$ to $1/10$ of eye-length. Wainwright (1940) described a *ssp. angustigena* from the British Isles which he

characterized as having a narrow frons and only one antero-dorsal bristle on the mid-tibia instead of a broad frons and 2—3 ad bristles as in the nominate form. According to the author, this subspecies may occur together with typical *rudis* and there are also transient specimens "which it is difficult to place". This statement alone suggests that we are hardly dealing with a subspecies in modern taxonomic meaning.

I have studied a very rich material from many localities in Europe and North Africa, and have found in almost all series Wainwright's *angustigena* together with *rudis*. The two features mentioned above occur, however, independently from each other. It is also easy to find those transitional specimens which Wainwright found difficult to place. *P.rudis angustigena* Wainwright is, therefore, not more than an individual variant which sometimes may be dominant in a population but, according to the dry material before me, also occurs in the same population together with the nominate form and readily interbreeds with it. It should be regarded as a mere synonym of *P.rudis* (F.) (**syn. nov.**)

Further species with a great variability of the width of frons are represented by *P.vespillo* (F.) and *P.dasyopoda* Portschinsky. In the former species, the width varies from 1/10 to 1/28, in the latter from 1/8 to 1/25 of eye length. In both species, this wide range seems to occur in all populations.

This is probably not true for *P.pallida* Rohdendorf. It was described from Turkestan and is furthermore known to me from the Balkan Peninsula, Hungary and Czechoslovakia, where only a forma *angustifrons* occurs with a width of frons of 1/17—1/25 of eye length. Wainwright in 1940 described a *Pollenia carinata* from Great Britain which I was able to study by the kindness of Mr. H. Oldroyd, British Museum. It proved to be a forma *latifrons* of *P.pallida* (**syn. nov.**)

I have only seen relatively few specimens of either the Eastern or Western form, and I can therefore not affirm whether there are mixed populations or not. If not, it would be justified to designate Wainwright's form as a subspecies. It is also not yet proved whether the *f.latifrons* only lives on the British Isles, or whether it also occurs in France as Wainwright records in his paper. In Western Europe, *Pollenia bisulca* Pandelle is found which can only be separated from *P.pallida f.latifrons* by the shape of the hypopygium.

The genus *Acrophaga* B.B.

The genus *Acrophaga* B.B. contains two described species with a boreo-alpine distribution, *A.laticornis* Zett. and *A.alpina* Zett., and two new species from the Alps which will be described in a later paper. This genus is closely related to *Calliphora* R.-D. from which I separated it by a wide male frons showing a frontal bristle and usually also a well developed external vertical bristle. In *A.subalpina* Ringdahl, these bristles are wanting and I therefore transfer it to the genus *Calliphora*. The width of frons is overlapping in both genera, varying in *Acrophaga* from 3/7 to 1/8, in *Calliphora* from 1/6 to 1/22 of eye-length.

There cannot be any doubt that the *Acrophaga* species are to be regarded as "broad-fronted" *Calliphora*, a view which is supported by the structure of the phallosomes. But they all represent good species which have probably been separated from the true *Calliphora* for a long time and which are now restricted to high altitudes in the Alps or to the subarctic North of Europe. They would be good examples of the supposed influence of alpine environmental factors on the size of eye, but I think that the foregoing examples prove that this explanation is not satisfactory.

A taxonomic question is, whether or not *Acrophaga* should be united with *Calliphora*? I have thought it over for a long time, and have decided to retain the two genera for the time being. The classification of the blue Calliphorini is extremely difficult. Only very few specimens of *Acrophaga* are available, also, I have seen only a few members of those North American species which are placed by Hall (1948) into the genus *Acronesia* Hall. This genus forms a kind of link between *Calliphora* and *Acrophaga* but the available material is not numerous and some of the species are very poorly known. When one day this American genus can be studied in more detail, the status of the genus *Acrophaga* should be checked once more.

Conclusion and Summary.

The width of the male frons is a variable feature in several genera of *Calliphorinae*; as examples the genera *Phumosia* R.-D., *Tricyclea* Wulp, *Keniella* Malloch of the Ethiopian region, and *Pollenia* R.-D. and *Acrophaga* B.B. of the Palaearctic region are discussed. The width of the male frons may vary within the same population showing all kinds of intermediate individual variants between the extremes, or there are broad-fronted and narrow-fronted strains (*f. latifrons* and *f. angustifrons*) which may occur together, or are geographically separated forming distinct subspecies.

The character of a broad frons in genera or species which are normally more or less holoptic in the male sex is not restricted to or typical for high altitudes. It occurs under various ecological conditions and is probably due to genes which are manifested and selected in different ways but not by conditions which are only prevalent in high altitudes.

Two new species are described, namely *Phumosia patersoni* n. sp. from Pt. St. Johns, Cape Province, and *Tricyclea par* n. sp. from Martin's Drift, Bechuanaland. *Keniella* Malloch (1929) is regarded as a synonym of *Tricyclea* Wulp (1884), and *Tricyclea currani* Zpt. (1953) a synonym of *T. analis* Malloch (1929). *Pollenia rudis angustigena* Wainwright (1940) represents the *f. latifrons* of *P. rudis* (F.), *Pollenia carinata* Wainwright (1940) the *f. latifrons* of *P. pallida* Rohdendorf. *Tricyclea fasciata* (Mcq.) is for the first time recorded from the Union of South African (Illovo Beach, Natal.)

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